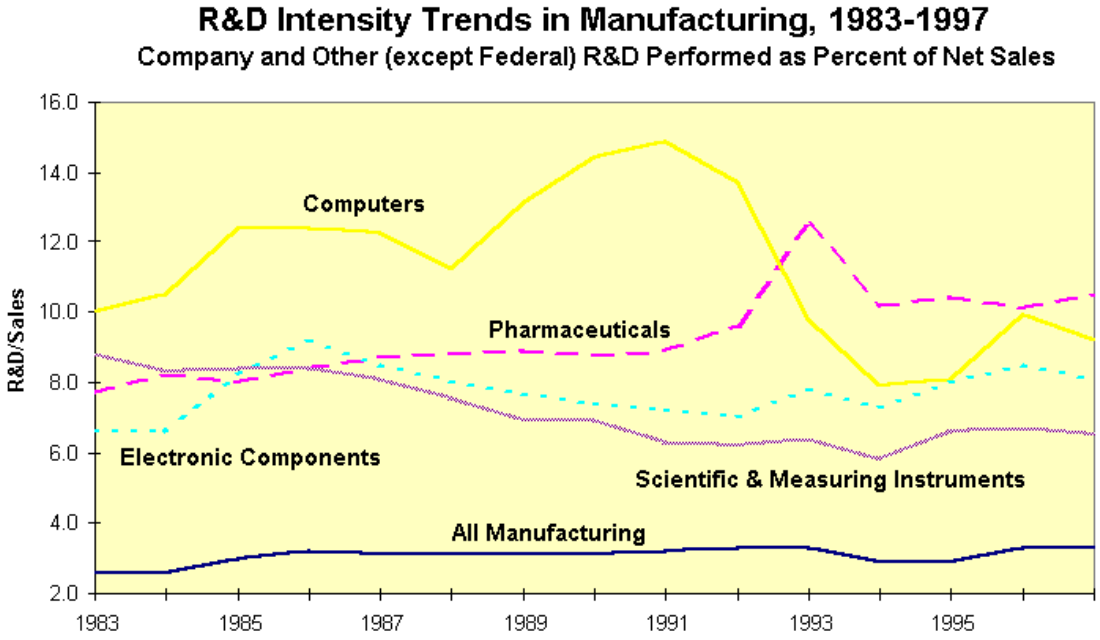
indicated in Figure 2, the company-funded R&D-to-sales ratio for all manufacturing industries increased from 2.6 percent in the early 1980s to 3.3 percent in 1997.

Figure 2



source: National Science Board [1998, Appendix Table 4-25 and updates

Service industries exhibit a similarly wide divergence in R&D intensity. The service sector as a whole had a company-funded R&D-to-sales ratio of 2.2 percent in 1996. However, individual industries vary enormously. Services such as transportation, utilities and FIRE (finance, insurance, and real estate) show ratios of 1.0 percent or less. Health services (at 5.9 percent) and engineering and management services (at 6.1 percent) are in the middle of the pack, while the leaders are 9.4 percent for R&D services and 12.4 percent for computer and data processing services. Surprisingly, service industries that are classified in the same industry group vary substantially with respect to R&D intensity. For example, computer and data processing is classified as one of a number of "business services," but other industries in this group have an average R&D-to-sales ratio of 1.1 percent.

The U.S. economy often is referred to as technology-based, and indigenous R&D capability is essential not only for innovation but also for efficiency in absorbing technology from external sources. High ratios of R&D to sales imply high rates of technological innovation and technology-based competition. High-tech industries also employ considerable technology from other industries and deliver a large portion of the technology used by the rest of the economy. Thus, they are critical to the overall economy along several dimensions.

> *Even with its significant leverage on the rest of the economy, the high-tech sector is too small to sustain desirable rates of economic growth given the continuing rapid increase in competitive positions of other national economies in moderate technology-based markets. Moreover, the high-tech sector not only is a relatively small portion of the U.S. economy, but also is*